

REMARKS

The Drawings have been amended according to the examiner's comment.

The Abstract has been amended to correct a typographical error.

The Prior Art has been amended to better explain the differences between the applicant's invention and the prior art.

The Description Of The Invention has been amended to show the advantages and non-obviousness of the current application over the prior art.

The Claims have been amended to correct format issues depicted by the examiner as well as for clarity. No material change and no narrowing were intended to the claims.

The present response is intended to be fully responsive to all points of objection and/or rejection raised by the Examiner and is believed to place the application in condition for allowance. Applicant asserts that the present invention is new, non-obvious and useful. Favorable reconsideration and allowance of the application is respectfully requested.

STATUS OF CLAIMS

Claims 1 to 9 are pending in the application

Claims 1 to 9 are rejected

Claims 1,2, 3, 4, 6, 7 and 9 have been objected to

Claims 2,3, and 7 have been rejected

Claims 2,3, have been voluntarily amended for clarification. No narrowing of the claims is intended.

ARGUMENTS TO CLAIM REJECTIONS

In the Office Action, the Examiner objected to claims 1, 2, 3, 4, 6, 7 and 9 because "they do not follow the proper format for a properly written claim". The examiner has also depicted the formatting corrections required for each claim. Claims 1 to 4 and 6, 7 and 9 have been amended to correct the format deficiency.

35 U.S.C. § 112 Rejections

In the Office Action, the Examiner rejected claims 1-9 under 35 U.S.C. § 112, first paragraph as 102 as being anticipated by Kurematsu (6,650,460)

Regarding claim 1, the Examiner stated that "Kurematsu discloses (refer to figures 1 and 2) a method of enhancing visibility at various light conditions (i.e., 1R, 1G, 1B) comprising steps like: focusing the desired object or view (source image) on a light modulating device (AMA 3) ; modulating the light of the focused image (object) by a device like a Light Control Panel (LCP) (4), such that desired image elements can have different intensities thus generating an enhanced image; and projecting the enhanced image with the magnification (column 4, lines 19 – 27, lines 66 – 67, column 5, lines 1 – 5)."

Kurematsu states that his patent is in the field of a projection type of display having an optical modulating device (mirror array device) controlling/reflecting one or three light sources (R, G and B color) created by a projecting optical system.

The mirror array device is selectively guided by the projecting system to project the light on a screen by controlling the tilt angle of each mirror in the array.

The Applicant's invention is using two optical systems: one mounted in the light path before the LCP for collimating the desired image, and the other behind the LCP for focusing and projecting the manipulated image to the observer's eye. Kurematsu's system uses an optical system only for projecting the reflected pixelated image of the mirror array and generating a projected image on the screen rather than on the

observer's eye. As such, the basic elements in Kurematsu's system are constructed in a different way than in the Applicant's system.

Referring to Fig 1 and 2 of Kurematsu's patent, the light source (RGB) [1] or monochrome [10] projected through an optic array comprises elements 20 and 21 or 22 to 24 on the mirror array [3] to be reflected by the active pixels (thus generating the required image) which are then projected on an external screen by another optical array [4].

The Applicant's invention is constructed differently, as depicted in Figure 4, where the invented system manipulates the natural image and projects it to the observer. Kurematsu's invention utilizes projected images generated by electronic processing media (Video, Computer, digital data etc.), where these images have to be first broken into their basic Red/Green/Blue components, which are then manipulated by the mirrors array and displayed to the observer as three separate colors like a picture created by a television set, while the current application uses a complete and natural image modified and enhanced by the Light Control Panel (LCP).

The LCP properties in the Applicant's system are also different than the displays technology DMD (Deformable Mirror Device), or AMA (Actuated Mirror Array) addressed in Kurematsu's patent, even though both have a pixelated element construction. The Light Control Panel used by the applicant's has a Light Sensitive Element (LSE) embedded within each individual pixel element (transmissive or reflective) that automatically controls each display pixel element (see Fig. 3), while Kurematsu's image is generated by a reflective array which is driven by an external source or image generator.

Kurematsu's projection system requires projection of the light components on the mirror array (No image is generated at this stage) while the Applicant's invention is not using such an optical element.

The Office Action Refers to Column 4, line 19-27 in Kurematsu's patent (6,650,460):

"An apparatus described above preferably has a feature that the angle ranges include first, second, third, and fourth ranges, when the tilt angle falls within the first

range, red is displayed on the projected surface, when the tilt angle falls within the second range, green is displayed on the projected surface, when the tilt angle falls within the third range, blue is displayed on the projected surface, and when the tilt angle falls within the fourth range, black is displayed on the projected surface."

In this paragraph Kurematsu emphasize the need for a projection display system which constructs the artificial image by manipulating the three basic colors and black with reflective mirrors that can be tilted at four discrete angles. This is different than the Applicant's invention which manipulates the real-image (all color elements at the same time without any separation) using a transparency or reflectivity control LCP that can continuously control the intensity.

The Office Action Refers to Column 4, lines 66-67, column 5, lines 1-5 in Kurematsu's patent (6,650,460):

"As shown in FIG. 1, a projection type display apparatus of the present invention comprises a thin-film AMA 3 for displaying an image by controlling the reflecting direction of light for each pixel using a thin-film piezoelectric actuator, single-color illumination units 1R, 1G, and 1B for irradiating the AMA 3 with three primary color light components, and a projecting optical system 4 for projecting reflected light of the R (red), G (green), and B (blue) light components with which the AMA 3 is irradiated. When the projection light is projected onto a screen (not shown), an image is displayed."

In this paragraph Kurematsu enforces the Applicant's statement that no true image is processed within his system, since the "light components" are not an image by itself. The thin-film AMA 3 contains piezoelectric actuators that control the mirrors which reflect the light components, while in the Applicant's (current) invention the light passes through the LCP where its intensity is manipulated by the change in transparency/reflectivity of every pixel. This transparency/reflectivity is controlled internally by a photo sensitive device (LSE) rather than by an external signal. Kurematsu's invention is based on a projection system, projecting R (red), G (green), and B (blue) light components then using mirrors to reflect these components at four optional directions, and then display the result as an artificial image, while the current

invention is manipulating the real image (as seen through the window, or a telescope, etc.) by changing the transparency/reflectivity of the LCP when the light (image) passes through it.

Regarding claim 2, the Office Action stated that “Kurematsu discloses, optics may comprise an optical array based on any optical technology as optical film array (AMA 3) (column 5, line 7).”

In Col 5 line 7 Kurematsu states: “...and a projecting optical system 4 for projecting reflected light of the R (red), G (green), and B (blue) light components with which the AMA 3 is irradiated.”

In this paragraph Kurematsu uses optical film array which is irradiated by the R G B light sources projected towards the AMA, while the applicant's LCP invention is using a mirror array with an embedded sensor in each pixel, which is different than the AMA. Also the in the LCP is manipulating a whole (natural) image rather than R G B light components. The applicant is using the optical relay for focusing the image on the LCP and projecting the manipulated image to the observer, while Kurematsu uses the optical array to project the RGB light components on the AMA.

Regarding claim 3, the Office Action stated that “Kurematsu discloses, wherein the light modulating system comprise a light control panel (LCP) based on any pixelated light modulating technology as reflective (column 6, lines 30 – 39).”

In Col 6 lines 30-39 Kurematsu states: “According to this embodiment, color switching and gray level display of each color light component can be done only by controlling the drive voltage to each pixel mirror.”

In this paragraph Kurematsu states that his invention requires drive voltage to control each pixel mirror. The Applicant's light control panel is different, since it is designed with the light controlled sensor embedded in each pixel, thus the light control is performed automatically within each pixel and does not require external drive signals.

Regarding claim 4, the Office Action stated that "Kurematsu discloses, where the source image is collimated (20) and manipulated such that the enhanced image appears to be originated from the source image; and whereby light and enhanced image can be of any frequency range in the spectrum (column 5, line 44)."

In Col 5 line 44, Kurematsu states: "condensed by collimator lenses 20, and reach a concave mirror 21."

In this paragraph Kurematsu describes his optical system constructed of elements 20 and 21 which collimates the light arriving from the R G B light sources. As said before this is a light source and not an image and this system is used to accumulate (originate) the light source beam and not generate a visible image as introduced in this application. The method introduced in this application can be implemented on any frequency range in the spectrum, Kurematsu calls for R G and B light source in the visible spectrum

Regarding claim 5, the Office Action stated that "Kurematsu discloses, where the same device used for focusing the desired object can be used for projecting and collimating enhanced image (as shown in figure 2)."

In figure 2 Kurematsu described his system as a projection system which focuses the image generated on the mirror array [3] (desired image) and projects the said image towards a screen.

The Applicant's invention is based on different elements and different structure, as depicted in figure 3. The main differences are follows:

The current invention is manipulating a natural image in order to provide the observer with an enhanced view of it, as opposed to the projection system required by Kurematsu to create the desired image.

Kurematsu is projecting the three light component (RGB) and manipulates them. In the current invention the Applicant is manipulating a complete and natural image, as can be seen by the observer.

The current invention does not require a display to present the enhanced image to the observer. The image projected after the LCP contains all the information, and

does not need a display, as opposed to Kurematsu that needs a display in order to combine the 3 separate light components (RGB) to one picture.

Also, the LCP properties in the current invention are different from the mirror array technology addressed in Kurematsu's invention. Although it has a pixelated construction, Kurematsu's light modulating device is using a reflective pixel array which is driven by external signals or image generator, while each pixel in the currently invented LCP is manipulating the image automatically based on the intensity of the incident light that passes through it. In addition, the applicant's enhanced image is projected back to the observer while in Kurematsu's system the generated image is projected on a screen.

Regarding claim 6, the Office Action stated that "Kurematsu discloses, a light control panel (LCP) comprising light modulator material, pixel electrodes, light sensitive elements and associated pixel control mechanism to produce image, where the optical characteristics of any pixel of image may be controlled by the light sensitive element; and whereby the light modulating material and light sensitive elements can be used at any frequency band in the spectrum (column 6, lines 10 – 47)."

In this paragraph, Kurematsu describes his optical modulating device, and states: "as more particularly, the gradient relationship between the pixel mirror tilt angle and the brightness of the projected image", and also "color switching and gray level display of each color light component can be done only by controlling the drive voltage to each pixel mirror". The Light Control Panel described in the current application is not using tilted mirrors to generate an image, and is not switching colors of light components. Rather, the Applicant's LCP is using a method of controlling the intensity of the natural image components by using a light sensitive element (e.g. phototransistor) embedded in each pixel.

Regarding claim 7, the Office Action stated that "Kurematsu discloses, where the light controlled panel is based on any pixilated light modulating technology as reflective (as shown in figure 2)."

As I have described the projection optical system is different from the Enhancing Observation System, a light reflective modulating device which shall have a light sensitive element on each of its constriction pixel element can serve as LCP. The LCP invention is the use of thus two elements within the pixel construction.

Regarding claim 8, the Office Action stated that “Kurematsu discloses, where the control mechanism may control the magnitude of the light modulation of the entire LCP in addition to controlling image pixels by the light sensitive element (column 6, lines 10 – 47).”

In Col 6 lines 10-47 Kurematsu says “When the characteristic shown in FIG. 5 and, more particularly, the gradient relationship between the pixel mirror tilt angle and the brightness of the projected image, which is indicated by S in FIG. 5, is used, gray level display of each color is possible. Referring to FIG. 5, the range near θ_b where the B light component exits from the projecting optical system 4 is the angle range for blue display. The range near 0° (or θ_g) where the G light component exits from the projecting optical system 4 is the angle range for green display. The range near θ_r where the R light component exits from the projecting optical system 4 is the angle range for red display. The range near θ_{bk} and on the positive side of the angle range for red display is the angle range for black display, i.e., the range wherein no light exits from the projecting optical system 4.

The pixel mirror tilt angle and the pixel mirror drive voltage have a proportional relationship shown in FIG. 6. Hence, the pixel mirror drive voltage and the brightness of the projected image have a relationship shown in FIG. 7, as is apparent from the above two relationships.

According to this embodiment, color switching and gray level display of each color light component can be done only by controlling the drive voltage to each pixel mirror. That is, gray level display of an R image is done using a gradient S_r (drive voltage is V_r1 to V_r2) in FIG. 7, gray level display of a G image is done using a

gradient S_g (drive voltage is V_{g1} to 0), and gray level display of a B image is done using a gradient S_b (drive voltage is $-V_{b1}$ to $-V_{b2}$). In addition, black display is done using a drive voltage V_{bk} . The drive voltage V_{bk} for black display can have any value.

In this embodiment, a full-color image may be displayed by a method of displaying primary color image frames on the projected surface (screen) in the order of RGBRGB . . . , i.e., time color mixing, or by a method of determining display colors for the respective pixels as a mosaic pattern and forming a pixel of the image to be projected on the projected surface (screen) using a plurality of pixel mirrors adjacent to each other, i.e., spatial color mixing."

As described above, the external driving voltage in Kurematsu's mirror array is used for tilting each pixel to the proper angle in order to generate an artificial image comprising of three basic colors and modulating its gray levels to construct the said image, while the LCP in the current application controls each pixel characteristics by the pixel embedded light sensor element. In addition to these sensors, the level to which the entire LCP can enhance the said image may be controlled by applying a single driving voltage to all the pixels, thus controlling the point relative to the light intensity where the pixels start manipulating the light (i.e. whether at higher or lower intensity the pixels will start manipulating the light).

Regarding claim 9, the Office Action stated that "Kurematsu discloses, a device like a Light Control Panel (LCP) in the light path of a system at a location where an image or a sub-image is created, such that desired image or sub image elements can have different intensities and whereby the method can be implemented for any frequency range in the electromagnetic spectrum (as shown in figure 2)."

As described above, since it is located in the path of the light (the full image), the LCP device described in the current application can control the image in any optical system. This is different than the mirror array device described by Kurematsu that is used to reconstruct artificial images from a video/image generator, requiring separation of any image to its Red Green and Blue components. Figure 2 illustrates a system for image projection connected to a video or computer source.

The current application describes in Figure 3 an observation system, which enhances the natural image using an LCP device.

Therefore, claims 1 to 9 are allowable over Kurematsu and should promptly be allowed.

Regarding Paragraph 8, the Office Action depicts “prior art made of record and not relied upon is considered pertinent to applicant's disclosure.”

The mentioned prior art was reviewed and found not applicable to the submitted application because of the following reasons:

Regarding the Office Action notice that “Simon (6,791,732 B2) discloses, the system and methods for altering the propagation of an optical signal within optical media.”

In this prior art Simon relates to systems and methods for altering the propagation of optical signals within optical media by using Optical modulators.

Although Simon uses a light modulator, this modulator controls the light transparency of the whole device using a separate sensor, and not on pixel-based light control panel where the sensor is embedded in the pixel as disclosed in the current application.

Regarding the Office Action notice that “Harel et al (6,549,692 B1) discloses, an optical monitoring of the angular position of micromirrors in an optical switch.”

This method is used to measure the tilted angle of a mirror array device, which is not related to the current application that does not require any means to measure angles.

Regarding the Office Action notice that “Helky (6,578,974 B2) discloses, micromachined apparatus for improved reflection of light.”

Helky's method addresses the ability to improve reflection of light from a mirror array device at the pixel level, which is not relevant to the current application since the

current invention can utilize any available technologies (Reflective, Transmissive, Polarizing, Rotating, Directing), regardless of their level of reflecting the light.

Regarding the Office Action notice that " Schofield (5,550,677) discloses, automatic rearview mirror system using a photosensor array."

Schofield's invention is related to Automatic rearview mirror system using a photosensor array, where he describes the method of using a camera and a video/image processing system to display on a panel a picture of the rear view image. This method controls the image by using the information from a sensor array (camera), which is separate from the pixels in the display panel, as an input to the processing system, while the applicant's sensors are embedded within each pixel in the LCP.

Conclusion

For all the above reasons, applicant submits that the specification and claims are now in proper form, and that the claims all define patentability over the prior art. Therefore he submits that this application is now in condition for allowance, which action he respectfully solicits.

Should the Examiner have any question or comment as to the form, content or entry of this Amendment, the Examiner is requested to contact the undersigned at the telephone number below.

Conditional Request For Constructive Assistance

Applicant has amended the specification and claims of this application so that they are proper, definite and define novel structure which is also unobvious. If, for any reason this application is not believed to be in full condition for allowance, applicant respectfully requests the constructive assistance and suggestions of the Examiner pursuant to M.P.E.P §2173.02 and §707.07(j) in order that the undersigned can place this application in allowable condition as soon as possible and without the need for further proceedings.

Respectfully submitted,



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Dated: 2005 March 15.



Jonathan Peeri